

ANNEX 1 TO CHAPTER 3

Example of possible modifications to Section II of Article S22

ARTICLE S22

Space services¹

Section II – Control of interference to geostationary-satellite systems

NOC S22.2
to
S22.5A

SUP S22.5B

Existing texts from S22.5C to S22.5G, including S22.5C.1 and S22.5D.1, are proposed to be replaced by the provisions below as modified from the draft CPM text.

MOD S22.5CB § 5 1) The equivalent power flux-density², EPFD_{down} at any point on the Earth's surface visible from the geostationary-satellite orbit, produced

¹ A.S22.1 In applying the provisions of this Article, the level of accepted interference (see No. S1.168) shall be fixed by agreement between the administrations concerned, using the relevant ITU-R Recommendations as a guide.

² ~~S22.5CB.1, C.1, D.1~~ The equivalent power flux-density is defined as the sum of the power flux-densities produced at a GSO receive station point on the Earth's surface or in the geostationary orbit, as appropriate, by all the transmit space-stations within a non-geostationary-satellite system, taking into account the off-axis discrimination of a reference receiving antenna assumed to be pointing towards the geostationary-satellite orbit in its nominal direction. The equivalent power flux-density is calculated using the following formula:

$$epfd = 10 \cdot \log_{10} \left[\sum_{i=1}^{N_s} 10^{pfd_i/10} \cdot \frac{G_r(\theta_i)}{G_{max}} \right]$$

$$EPFD = 10 \cdot \log_{10} \left[\sum_{i=1}^{N_a} \frac{P_i}{4 \cdot \pi d_i^2} \cdot \frac{G_t(\theta_i)}{G_{r,max}} \right]$$

where:

N_a is the number of transmit stations in the non-geostationary-satellite system that are visible from the GSO receive station considered on the Earth's surface or in the geostationary orbit, as appropriate;

i is the index of the transmit station considered in the non-geostationary-satellite system;

by emissions from all the space stations of a non-geostationary-satellite system in the fixed-satellite service in the frequency bands listed in Tables ~~S22-1~~, S22-1A to S22-1D, including emissions from a reflecting satellite, for all conditions and for all methods of modulation, shall not exceed the limits given in Tables ~~S22-1~~ S22-1A to S22-1D for the given percentages of time. These limits relate to the equivalent power flux-density which would be obtained under free-space propagation conditions, into a reference antenna and in the reference bandwidth specified in Tables ~~S22-1~~ S22-1A to S22-1D, for all pointing directions towards the geostationary-satellite orbit. —(WRC 97)

P_i	is the RF power at the input of the antenna of the transmit station, considered in the non-geostationary satellite system in dBW in the reference bandwidth;
θ_i	is the off-axis angle between the boresight of the transmit station considered in the non-geostationary satellite system and the direction of the GSO receive station;
$G_t(\theta_i)$	is the transmit antenna gain (as a ratio) of the station considered in the non-geostationary satellite system in the direction of the GSO receive station;
d_i	is the distance in metres between the transmit station considered in the non-geostationary satellite system and the GSO receive station;
ϕ_i	is the off-axis angle between the boresight of the antenna of the GSO receive station and the direction of the i th transmit station considered in the non-geostationary satellite system;
$G_r(\phi_i)$	is the receive antenna gain (as a ratio) of the GSO receive station in the direction of the i th transmit station considered in the non-geostationary satellite system;
$G_{r,max}$	is the maximum gain (as a ratio) of the antenna of the GSO receive station;
$EPFD$	is the computed equivalent power flux-density in dB(W/m ²) in the reference bandwidth.

N_g : number of non-geostationary space stations visible from the point considered at the Earth's surface, within an elevation angle greater than or equal to 0°;

i : index of the non-geostationary space station considered;

pfd_i : power flux density produced at the point considered on the Earth's surface in dB(W/m²) in the reference bandwidth;

θ_i : angle between the direction considered towards the geostationary satellite orbit and the direction of the interfering space station in the non-geostationary satellite system;

$G_r(\theta_i)$: gain (as a ratio) of the receive reference antenna to be considered as part of a geostationary satellite network;

G_{max} : maximum gain (as a ratio) of the above receive reference antenna;

$epfd$: computed equivalent power flux density in dB(W/m²) in the reference bandwidth.

TABLE S22-1 (WRC-97)

Frequency band allocated to the broadcasting-satellite service	Antenna diameter (cm)	Equivalent pfd-level (dB(W/m ² /4 kHz)) which may not be exceeded during the percentage of time shown		Reference antenna radiation pattern
		99.7%	100%	
11.7-12.5 GHz in Region 1, 11.7-12.2 GHz and 12.5-12.75 GHz in Region 3	30 60 90	-172.3 -183.3 -186.8	-169.3 -170.3 -170.3	Recommendation ITU-R BO.1213
12.2-12.7 GHz in Region 2	45 100 120 180	-174.3 -186.3 -187.9 -191.4	-165.3 -170.3 -170.3 -170.3	§ 3.7.2 of Annex 5 of Appendix S30
17.3-17.8 GHz in Region 2	For further study*			

*—The interference from non-geostationary fixed-satellite service (non-GSO FSS) systems into geostationary broadcasting-satellite service (GSO BSS) systems operating in the frequency bands 17.3-17.8 GHz relates to the two following sharing situations:

- non-GSO FSS transmit earth station into GSO receive earth station;
- GSO BSS transmit space station into non-GSO FSS receive space stations.

Both situations need to be studied, in particular since coexistence of receive BSS earth stations and large numbers of transmit non-GSO FSS terminals would not be feasible within the same country

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TABLE ~~S22-1~~S22-1A^{1,3}Limits to the EPFD_{down} radiated by non-GSO FSS systems in certain frequency bands

Frequency band (GHz)	Equivalent pfdEPFD _{down} dB(W/m ²)	Percentage of time during which equivalent pfdEPFD _{down} level may not be exceeded	Reference bandwidth (kHz)	Reference antenna diameter, and reference radiation pattern ²
10.7-11.7 in all Regions; 11.7-12.2 in Region 2; 12.2-12.5 in Region 3 and 12.5-12.75 in Regions 1 and 3	-175.4	0	40	60 cm Recommendation S. {4/57}
	-174.0	90		
	-170.8	99		
	-165.3	99.73		
	-160.4	99.991		
	-160.0	99.997		
	-160.0	100		
	-181.9	0	40	1.2 m Recommendation S. {4/57}
	-178.4	99.5		
	-173.4	99.74		
	-173.0	99.857		
	-164.0	99.954		
	-161.6	99.984		
	-161.4	99.991		
	-160.8	99.997		
	-160.5	99.997		
	-160.0	99.9993		
	-160.0	100		
	<u>-190.45</u>	<u>0.00</u>	40	3 m Recommendation S. {4/57}
	<u>-189.45</u>	<u>90.00</u>		
	<u>-187.45</u>	<u>99.50</u>		
	<u>-182.4</u>	<u>99.70</u>		
	<u>-182</u>	<u>99.855</u>		
	<u>-168</u>	<u>99.971</u>		
	<u>-164</u>	<u>99.988</u>		
	<u>-162</u>	<u>99.995</u>		
	<u>-160</u>	<u>99.999</u>		
	<u>-160</u>	<u>100.000</u>		

	<u>-195.45</u>	<u>0.00</u>	40	10 m Recommendation S.4(57)
	<u>-195.45</u>	<u>99.00</u>		
	<u>-190.00</u>	<u>99.65</u>		
	<u>-190</u>	<u>99.71</u>		
	<u>-172.5</u>	<u>99.99</u>		
	<u>-160</u>	<u>99.998</u>		
	<u>-160</u>	<u>100.000</u>		

- ¹ For certain receive earth stations, see also ADD S9.7A and ADD S9.7B.
- ² Under this Section, reference patterns are to be used only for the calculation of interference from non-GSO FSS systems into GSO FSS and BSS systems.
- ³ ~~No agreement could be reached on EPFD_{down} values for protection of the 3-m and 10-m GSO FSS antennas. See § 3.1.4.1.4.2 a) of the text.~~
- ³ In addition to the limits shown in this table ~~FSS single entry masks above, the a second single entry-EPFD_{down} limits in Table S22-1A' apply to all antenna sizes greater than 60cm in the frequency bands listed in this table. was identified:~~

TABLE S22-1A'

Limits to the EPFD_{down} radiated by non-GSO FSS systems at certain latitudes

100% of the time EPFD _{down} dB(W/(m ² ·40 kHz))	Latitude (North or South) (°)
-160	0 < Latitude ≤ 57.5
-160 + 3.48(57.5 - ABS(Latitude))/45	57.5 < Latitude ≤ 62.563.75
<u>-165.3TBD</u>	<u>62.563.75 ≤ Latitude </u>

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TABLE ~~S22-1~~S22-1B¹Limits to the EPFD_{down} radiated by non-GSO FSS systems in certain frequency bands

Frequency band (GHz)	EPFD _{down} dB(W/m ²)	Percentage of time during which equivalent pfdEPFD _{down} may not be exceeded	Reference bandwidth (kHz)	Reference antenna diameter, and reference pattern ²
17.8-18.6	-164	100	40 ³	1 m Recommendation S.4(4/57)
	-164	99.971		
	-167	99.714		
	-172.5	99		
	-175.4	90		
	-175.4	0		
	-150	100	1000	
	-150	99.971		
	-153	99.714		
	-158.5	99		
	-161.4	90		
	-161.4	0		
17.8-18.6	-164	100	40 ³	2 m Recommendation S.4(4/57)
	-164	99.977		
	-166	99.971		
	-170.5	99.913		
	-171.4	99.9		
	-178.4	99.4		
	-178.4	0		
	-150	100	1 000	
	-150	99.977		
	-152	99.971		
	-156.5	99.913		
	-157.4	99.9		
-164.4	99.4			
-164.4	0			
17.8-18.6	-164	100	40 ³	5 m Recommendation S.4(4/57)
	-164	99.998		
	-172	99.943		
	-180	99.943		
	-180	99.8		
	-185.4	99.8		
	-185.4	0		
	-150	100	1 000	
	-150	99.998		
	-158	99.943		
	-166	99.943		
	-166	99.8		
-171.4	99.8			
-171.4	0			

¹ For certain receive earth stations, see also ADD S9.7A and ADD S9.7B.

- ² Under this Section, reference patterns are to be used only for the calculation of interference from non-GSO FSS systems into GSO FSS and BSS systems.
- ³ ~~For non-GSO emission bandwidths greater than 40 kHz, the EPFD_{down} limits may be scaled by adding 10 log(non-GSO emission bandwidth/40 kHz) in a reference bandwidth equal to the emission bandwidth.~~

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TABLE ~~S22-1~~S22-1C¹Limits to the EPFD_{down} radiated by non-GSO FSS systems in certain frequency bands

Frequency band (GHz)	EPFD _{down} dB(W/m ²)	Percentage of time during which equivalent pfdEPFD _{down} may not be exceeded	Reference bandwidth (kHz)	Reference antenna diameter, and reference pattern ²
19.7-20.2	-154 -154 -172 -182 -187.4	100 99.983 97.143 71.429 0	40 ³	70 cm Recommendation S. S.4/57
	<u>-140</u> <u>-140</u> <u>-158</u> <u>-168</u> <u>-173.4</u>	<u>100</u> <u>99.983</u> <u>97.143</u> <u>71.429</u> <u>0</u>	<u>1 000</u>	
19.7-20.2	-154 -154 -160 -165 -168.6 -170.4 -181.4 -190.4	100 99.997 99.943 99.943 99.8 99.8 91 0	40 ³	90 cm Recommendation S. S.4/57
	<u>-140</u> <u>-140</u> <u>-146</u> <u>-151</u> <u>-154.6</u> <u>-156.4</u> <u>-167.4</u> <u>-176.4</u>	<u>100</u> <u>99.997</u> <u>99.943</u> <u>99.943</u> <u>99.8</u> <u>99.8</u> <u>91</u> <u>0</u>	<u>1 000</u>	
19.7-20.2	-154.35 -154.35 -162 -196.4	100 99.99943 9971 99.98 0	40 ³	2.5 m Recommendation S.4/57 see Note 4
	<u>-140</u> <u>-140</u> <u>-148</u> <u>-182.4</u>	<u>100</u> <u>99.99943</u> <u>99.98</u> <u>0</u>	<u>1 000</u>	

19.7-20.2	-154.35	100	40 ⁻³	5 m Recommendation S.4(57) see Note 4
	-154	99.9992		
	-154.635	99.999		
	-164.2163.5	99.99		
	-175	99.886		
	-184	97.143		
	-187.89	9492		
	-189.4	90		
	-195	66		
	-200.4	0		
	-140	100	1 000	
	-140	99.9992		
	-140.6	99.999		
	-150.2	99.99		
	-161	99.886		
	-170	97.143		
	-173.8	94		
	-175.4	90		
	-186.4	0		

- ¹ For certain receive earth stations, see also ADD S9.7A and ADD S9.7B.
- ² Under this Section, reference patterns are to be used only for the calculation of interference from non-GSO FSS systems into GSO FSS and BSS systems.
- ³ ~~For non-GSO emission bandwidths greater than 40 kHz, the EPFD_{down} limits may be scaled by adding $10 \log(\text{non-GSO emission bandwidth}/40 \text{ kHz})$ in a reference bandwidth equal to the emission bandwidth.~~
- ⁴ ~~The masks for the 2.5m and 5m antennas have not been agreed. Further adjustments to these masks are required.~~

Examples of possible modifications to Section II of Article S22

TABLE S22-1D²

Limits to the EPFD_{down} radiated by non-GSO FSS systems in certain frequency bands
30 cm, 45 cm, 60 cm, 90 cm, 120 cm, 180 cm, 240 cm and 300 cm BSS antennas

Frequency band (GHz)	EPFD _{down} dB(W/m ²)	Percentage of time during which EPFD _{down} level may not be exceeded	Reference bandwidth (kHz)	Reference antenna diameter, and reference radiation pattern ¹
11.7-12.5 GHz In Region 1	-165.841	0.000	40	30 cm DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1]
11.7-12.2 GHz and 12.5-12.75 GHz In Region 3	-165.541	25.000		
	-164.041	96.000		
12.2-12.7 GHz In Region 2	-158.600	98.857		
	-158.600	99.429		
	-158.330	99.429	40	45 cm DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1]
	-158.330	100.000		
11.7-12.5 GHz In Region 1	-175.441	0.000		
11.7-12.2 GHz and 12.5-12.75 GHz In Region 3	-172.441	66.000		
	-169.441	97.750		
12.2-12.7 GHz In Region 2	-164.000	99.357	40	60 cm DNR ITU-R BO.[Doc. 11/137(Rev.1) Annex 1]
	-160.750	99.809		
	-160.000	99.986		
	-160.000	100.000		
11.7-12.5 GHz In Region 1	-176.441	0.000		
11.7-12.2 GHz and 12.5-12.75 GHz In Region 3	-173.191	97.800	40	
	-167.750	99.371		
12.2-12.7 GHz In Region 2	-162.000	99.886		
	-161.000	99.943		
	-160.200	99.971		
	-160.000	99.997	40	
	-160.000	100.000		

11.7-12.5 GHz In Region 1 11.7-12.2 GHz and 12.5-12.75 GHz In Region 3 12.2-12.7 GHz In Region 2	-178.94	0.000	40	90 cm DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1]
	-178.44	33.000		
	-176.44	98.000		
	-171.00	99.429		
	-165.50	99.714		
	-163.00	99.857		
	-161.00	99.943		
	-160.00	99.991		
	-160.00	100.000		
11.7-12.5 GHz In Region 1 11.7-12.2 GHz and 12.5-12.75 GHz In Region 3 12.2-12.7 GHz In Region 2	-182.440	0.000	40	120 cm DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1]
	-180.690	90.000		
	-179.190	98.900		
	-178.440	98.900		
	-174.940	99.500		
	-173.750	99.680		
	-173.000	99.680		
	-169.500	99.850		
	-167.800	99.915		
	-164.000	99.940		
	-161.900	99.970		
	-161.000	99.990		
	-160.400	99.998		
	-160.000	100		
11.7-12.5 GHz in Region 1 11.7-12.2 GHz and 12.5-12.75 GHz in Region 3 12.2-12.7 GHz in Region 2	-184.941	0.000	40	180 cm DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1]
	-184.101	33.000		
	-181.691	98.500		
	-176.250	99.571		
	-163.250	99.946		
	-161.500	99.974		
	-160.350	99.993		
	-160.000	99.999		
	-160.000	100.000		

11.7-12.5 GHz in Region 1	-187.441	0.000	40	240 cm DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1]
	-186.341	33.000		
	-183.441	99.250		
	-178.000	99.786		
	-164.400	99.957		
11.7-12.2 GHz and 12.5-12.75 GHz in Region 3	-161.900	99.983	40	300 cm DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1]
	-160.500	99.994		
12.2-12.7 GHz in Region 2	-160.000	99.999		
	-160.000	100.000		
	-160.000	100.000		
11.7-12.5 GHz In Region 1	-191.941	0.000	40	300 cm DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1]
	-189.441	33.000		
	-185.941	99.500		
	-180.500	99.857		
	-173.000	99.914		
11.7-12.2 GHz and 12.5-12.75 GHz In Region 3	-167.000	99.951	40	300 cm DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1]
	-167.000	99.951		
12.2-12.7 GHz In Region 2	-162.000	99.983		
	-160.000	99.991		
	-160.000	100.000		

- Under this Section, reference patterns are to be used only for the calculation of interference from non-GSO FSS systems into GSO FSS and BSS systems.
- For BSS antenna diameters 180 cm, 240 cm and 300 cm, in addition to the single-entry limits shown in Table S22-1D, the following single-entry 100% of the time EPFD_{down} limit also applies in the frequency band listed in Table S22-1D:

100% of the time EPFD _{down} dB(W/(m ² ·40 kHz))	Latitude (North or South) (°)
-160.0	$0 \leq \text{latitude} \leq 57.5$
$-160.0 + 3.4 * (57.5 - \text{latitude})/4$	$57.5 \leq \text{latitude} \leq 63.75$
-165.3	$63.75 \leq \text{latitude} $

*For BSS antenna diameter 240 cm, in addition to the above single-entry 100% of the time EPFD_{down} limit, a -167 dB(W/(m²·40 kHz)) single-entry 100% of the time operational EPFD_{down} limit also applies to receive antennas located in Region 2, west of 140° W, north of 60° N, pointing toward

GSO BSS satellites at 91° W, 101° W, 110° W, 119° W and 148° W with elevation angles greater than 5°. [This limit is implemented during a transition period of [15] years.]*

MOD S22.5D0

2) The ~~aggregate equivalent~~ power flux-density²³, $EPFD_{up}$, produced at any point in the geostationary-satellite orbit by emissions from all the earth stations in a non-geostationary-satellite system in the fixed-satellite service in the frequency bands listed in Table S22-2, for all conditions and for all methods of modulation, shall not exceed the limits given in Table S22-2 for the specified percentages of time. These limits relate to the equivalent power flux-density which would be obtained under free-space propagation conditions, into a reference antenna and in the reference bandwidth specified

* This transitional regime would be applicable only if the pfd limits in section 5c of Annex 1 to Appendix S30 are sufficiently relaxed.

²³ ~~S22.5D.1~~ — The aggregate power flux density is defined as the sum of the power flux densities produced at a point in the geostationary satellite orbit by all the earth stations of a non-geostationary satellite system. The aggregate power flux density is computed by means of the following formula:

$$apfd = 10 \cdot \log_{10} \left[\sum_{i=1}^{N_e} 10^{P_i/10} \cdot \frac{G_i(\theta_i)}{4 \pi d_i^2} \right]$$

where:

N_e : — ~~number of earth stations in the non-geostationary satellite system with an elevation angle greater than or equal to 0°, from which the point considered in the geostationary satellite orbit is visible;~~

i : — ~~index of the earth station considered in the non-geostationary satellite system;~~

P_i : — ~~RF power at the input of the transmitting antenna of the earth station considered in the non-geostationary satellite system in dBW in the reference bandwidth;~~

θ_i : — ~~off axis angle between the boresight of the earth station considered in the non-geostationary satellite system and the direction of the point considered in the geostationary satellite orbit;~~

$G_i(\theta_i)$: ~~transmit antenna gain (as a ratio) of the earth station considered in the non-geostationary satellite system in the direction of the point considered in the geostationary satellite orbit;~~

d_i : — ~~distance in metres between the earth station considered in the non-geostationary satellite system and the point considered in the geostationary satellite orbit;~~

$apfd$: — ~~aggregate power flux density in dB(W/m²) in the reference bandwidth.~~

NOTE ~~Tables S22-1 to S22-4 and Nos. S22.26 to S22.29 contain provisional limits corresponding to an interference level caused by one non-geostationary fixed-satellite-service system in the frequency bands to be applied in accordance with Resolutions 130 (WRC-97) and 538 (WRC-97). These provisional limits are subject to review by ITU-R and are subject to confirmation by WRC-99. (WRC-97)~~

in Table S22-2, for all pointing directions towards the Earth's surface visible from any given location in the geostationary-satellite orbit. — (WRC 97)

TABLE S22-2 (WRC 97)

Frequency band (GHz)	Aggregate pfd dB(W/m ² /4 kHz)	Percentage of time during which aggregate pfd level may not be exceeded
17.3-18.1 in Regions 1 and 3 and 17.8-18.1 in Region 2	-163	100%

S22.5E — 3) — The equivalent power flux density⁴, at any point on the Earth's surface visible from the geostationary satellite orbit, produced by emissions from all the space stations of a non-geostationary satellite system in the fixed-satellite service in the frequency bands listed in Table S22-3, including emissions from a reflecting satellite, for all conditions and for all methods of modulation, shall not exceed the limits given in Table S22-3 for the given percentages of time. These limits relate to the equivalent power flux density which would be obtained under free space propagation conditions into all the reference antennas and in the reference bandwidths specified in Table S22-3, and for all pointing directions towards the geostationary satellite orbit. — (WRC 97)

TABLE S22-2

Limits to the EPFD_{up} radiated by non-GSO FSS systems in certain frequency bands

Frequency band (GHz)	EPFD _{up} dB(W/m ²)	Percentage of time EPFD _{up} level may not be exceeded	Reference bandwidth (kHz)	Reference antenna beamwidth and reference radiation pattern ²
12.50-12.75 12.75-13.25 13.75-14.5	-160	100	40	4 degrees ITU-R S.672, Ls = -20 ¹
*	-160	100	40	4 degrees ITU-R S.672, Ls = -20 ¹
27.5-28.6	-162	100	40	1.55 degrees ITU-R S.672, Ls = -10 ¹
29.5-30.0	-162	100	40	1.55 degrees ITU-R S.672, Ls = -10 ¹

⁴— **S22.5E.1** — See No. **S22.5C.1**. — (WRC 97)

- ¹ For the case of $L_s = -10$, the values $a = 1.83$ and $b = 6.32$ should be used in the equations in Annex 1 of Recommendation ITU-R S.672 for single-feed circular beams. In all cases of L_s , the parabolic main beam equation should start at zero.
- * This EPFD_{up} limit applies to the bands 17.3-18.1 GHz (Regions 1 and 3) and 17.8-18.1 GHz (Region 2). It is proposed that the above-mentioned limit be also applicable to the frequency band 17.3-17.8 GHz (Region 2), in order to protect BSS feeder links in Region 2 from non-GSO FSS uplinks in Regions 1 and 3. See also section 3.2.2.

TABLE S22.3 (WRC 97)

PART A

Frequency band (GHz)	Equivalent pfd dB(W/m ²)	Percentage of time during which equivalent pfd level may not be exceeded	Reference bandwidth (kHz)	Reference antenna diameter, and reference radiation pattern
10.7-11.7;	-179	99.7	4	60 cm, Rec. ITU R S.465-5
11.7-12.2	-192	99.9	4	3 m, Rec. ITU R S.465-5
in Region 2;	-186	99.97	4	3 m, Rec. ITU R S.465-5
12.2-12.5	-195	99.97	4	10 m, Rec. ITU R S.465-5
in Region 3 and	-170	99.999	4	60 cm, Rec. ITU R S.465-5
12.5-12.75	-173	99.999	4	3 m, Rec. ITU R S.465-5
in Regions 1	-178	99.999	4	10 m, Rec. ITU R S.465-5
and 3	-170	100	4	≥ 60 cm, Rec. ITU R S.465-5

TABLE S22-3 (WRC 97)

PART B

Frequency band (GHz)	Equivalent pfd dB(W/m ²)	Percentage of time during which equivalent pfd level may not be exceeded	Reference bandwidth (kHz)	Reference antenna diameter, and reference radiation pattern
17.8-18.6	-165	99.0	40	30 cm, Rec. ITU R S.465-5
	-151		1000	
	-165	99.0	40	70 cm, Rec. ITU R S.465-5
	-151		1000	
	-165	99.5	40	90 cm, Rec. ITU R S.465-5
	-151		1000	
	-167	99.8	40	1.5 m, Rec. ITU R S.465-5
	-153		1000	
	-180	99.9	40	5 m, Rec. ITU R S.465-5
	-166		1000	
	-184	99.9	40	7.5 m, Rec. ITU R S.465-5
	-170		1000	
	-188	99.9	40	12 m, Rec. ITU R S.465-5
	-174		1000	
	-165	100	40	30 cm to 12 m,
	-151		1000	Rec. ITU R S.465-5
19.7-20.2	-154	99.0	40	30 cm, Rec. ITU R S.465-5
	-140		1000	
	-164	99.9	40	90 cm, Rec. ITU R S.465-5
	-150		1000	
	-167	99.8	40	2 m, Rec. ITU R S.465-5
	-153		1000	
	-174	99.9	40	5 m, Rec. ITU R S.465-5
	-160		1000	
	-154	100	40	30 cm to 12 m,
	-140		1000	Rec. ITU R S.465-5

MOD S22.5FD

43) The aggregate equivalent power flux-density²⁵, EPFD_{is}, produced at any point in the geostationary-satellite orbit by emissions from all the earth space stations in a non-geostationary-satellite system in the fixed-satellite service in the frequency bands listed in Table S22-3, including emissions from a reflecting satellite, for all conditions and for all methods of modulation, shall not exceed the limits given in Table S22-43 for the specified any-percentages of time. These limits relate to the equivalent power flux-density which would be obtained under free-space propagation conditions into a the-reference

²⁵ S22.5F.1 See No. S22.5D.1. (WRC 97)

antenna and in the reference bandwidth specified in Table S22-43, for all pointing directions towards the Earth's surface visible from any given location in the geostationary-satellite orbit. —(WRC 97)

MOD

TABLE S22-3

Limits to the EPFD_{is} radiated by non-GSO FSS systems in certain frequency bands

Frequency band (GHz)	EPFD _{is} dB(W/m ²)	Percentage of time EPFD _{is} level may not be exceeded	Reference bandwidth (kHz)	Reference antenna beamwidth and reference radiation pattern ¹
10.7-11.7 (Region 1)	-160	100	40	4 degrees ITU-R S.672, Ls = -20
12.5-12.75 (Region 1)				
12.7-12.75 (Region 2)				
17.8-18.4	-160	100	40	4 degrees ITU-R S.672, Ls = -20

¹ Under this Section, this reference pattern is to be used only for the calculation of interference from non-GSO FSS systems into GSO FSS systems.

TABLE S22-4 (WRC 97)

PART A

Frequency band (GHz)	Aggregate pfd dB(W/m ²)	Percentage of time during which aggregate pfd level may not be exceeded	Reference bandwidth (kHz)
12.5-12.75	-170	100	4
12.75-13.25	-186	100	4
13.75-14.5	-170	100	4

TABLE ~~S22-4~~ (WRC-97)

PART B

Frequency band (GHz)	Aggregate pfd dB(W/m ²)	Percentage of time during which aggregate pfd level may not be exceeded	Reference bandwidth (kHz)
27.5-28.6 and 29.5-30	-159 -145	+00 +00	40 +000

MOD S22.5GE The limits given in Tables ~~S22-1A to S22-1D~~ and ~~S22-3~~ may be exceeded on the territory of any country whose administration has so agreed. ~~—(WRC-97)~~

ADD S22.5HF The limits specified in No. **S22.5B** to **S22.5D** apply to non-GSO FSS systems for which complete coordination or notification information, as appropriate, has been received after 22 November 1997.

Reasons: Reflect the "instructs the Radiocommunication Bureau" in Resolutions 130 (WRC-97) and 538 (WRC-97), and resolves 2 of Resolution 130 (WRC-97). Review of the findings by the Bureau under "instructs the Radiocommunication Bureau" in Resolution 130 (WRC-97) and Resolution 538 (WRC-97) should be kept in an updated version of these resolutions to cover transitional aspects. It was noted that no notification was received prior to 22 November 1997 for non-GSO FSS systems (Earth-to-space) in the bands 17.3-18.1 GHz (Regions 1 and 3) and 17.8-18.1 GHz (Region 2).

ADD S22.5IG An administration operating a non-GSO FSS system which is in compliance with the limits in No. **S22.5B** to **S22.5D** (see also Resolution **WWW**) shall be considered as having fulfilled its obligations under No. **S22.2** with respect to any GSO network, irrespective of the dates of receipt by the Bureau of the complete coordination or notification information, as appropriate, for the non-GSO system and of the complete coordination information for the GSO network, provided that the EPFD_{down} radiated by the non-GSO FSS system into any operating GSO FSS earth station does not exceed the operational limits given in Table **S22-4A** and **S22-4B**, when the gain of this earth station is equal to or greater than the corresponding value given in Table **S22-4A** and **S22-4B** for the corresponding orbital inclination of the GSO FSS satellite as given in Table **S22-4A** and **S22-4B**. Except as otherwise agreed between concerned administrations, An administration operating a non-GSO FSS system that is subject to the limits in No. **S22.5B** to **S22.5D** and which radiates EPFD_{down} into any operating GSO FSS earth station at levels in excess of the operational limits given in Table **S22-4A** and **S22-4B**, when the gain of this earth station is equal to or greater than the corresponding value given in Table **S22-4A** and **S22-4B** for the corresponding orbital inclination of the GSO FSS satellite as given in Table **S22-4A** and **S22-4B**, shall be considered to be in violation of its obligations under No. **S22.2**.

Reasons: Reflect the *resolves* 4 and 1.4 of Resolutions 130 (WRC-97) and 538 (WRC-97), and the principles provided in section 3.1.2.1.4.2 c). Other additions to the provision correct the language, and make explicit the intention that any non-GSO FSS system that exceeds the validation or operational limits, as applicable, shall, except otherwise agreed between concerned administrations be deemed to be in violation of its obligations under No. S22.2.

TABLE S22-4A^{1,3}

**Operational limits to the EPFD_{down} radiated by non-GSO FSS
systems in certain frequency bands**

Frequency band (GHz)	EPFD _{down} dB(W/m ²)	Percentage of time during which EPFD _{down} may not be exceeded	Reference bandwidth (kHz)	Receive GSO earth station antenna diameter ² (m)	Orbital inclination of GSO satellite (degrees)
10.7-11.7 in all Regions 11.7-12.2 in Region 2 12.2-12.5 in Region 3 and 12.5-12.75 in Region 3 and 3 (prior to 31 December 2005)	-163	100	40	3	≤2.5
	-166			6	
	-167.5			9	
	-169.5			≥18	
10.7-11.7 in all Regions 11.7-12.2 in Region 2 12.2-12.5 in Region 3 and 12.5-12.75 in Region 3 and 3 (after 31 December 2005)	-160	100	40	3	≤4.5
	-163			6	
	-164.5			9	
	-166.5			≥18	
10.7-11.7 in all Regions 11.7-12.2 in Region 2 12.2-12.5 in Region 3 and 12.5-12.75 in Region 3 and 3 (after 31 December 2005)	-161.25	100	40	3	≤2.5
	-164			6	
	-165.5			9	
	-167.5			≥18	
10.7-11.7 in all Regions 11.7-12.2 in Region 2 12.2-12.5 in Region 3 and 12.5-12.75 in Region 3 and 3 (after 31 December 2005)	158.25	100	40	3	≤4.5
	-161			6	
	-162.5			9	
	-164.5			≥18	

¹ For certain receive earth stations, see also ADD S9.7A and ADD S9.7B.

² Linear interpolation of EPFD levels in decibels should be performed for other intermediate antenna diameters.

³ In addition to the operational limits shown in Table S22-4A, the additional operational limits in Tables S22-4A1 and S22-4A2 apply to certain GSO FSS earth station antenna sizes in the frequency bands listed in Table S22-4A.

ADD

TABLE S22-4A1

Additional operational limits to the EPFD_{down} radiated by non-GSO FSS systems
into 3 m GSO FSS earth station antenna

EPFD _{down} (dB(W/(m ² /40 kHz)))	Percentage of time during which EPFD _{down} may be exceeded
-182	0.1
-179	0.06
-176	0.03
-171	0.02
-168	0.016
-165	0.007
-163	0.001
-161.25	0.00025
-161.25	0

ADD

TABLE [S22-4A2]

Additional operational limits to the EPFD_{down} radiated by non-GSO FSS systems
into 10 m GSO FSS earth station antenna

EPFD _{down} (dB(W/(m ² /40 kHz)))	Percentage of time during which EPFD _{down} may be exceeded
-185	0.03
-183	0.02
-179	0.01
-175	0.004
-171	0.002
-168	0.001
-166	0.0002
-166	0

MOD

TABLE ~~S22-4~~**S22-4B**¹

Operational limits to the EPFD_{down} radiated by non-GSO FSS systems in certain frequency bands

Frequency band (GHz)	EPFD _{down} dB(W/m ²)	Percentage of time during which equivalent pdf EPFD _{down} may not be exceeded	Reference bandwidth (kHz)	Receive GSO earth station antenna Gain (dBi)	Orbital inclination of GSO satellite (degrees)
19.7–20.2	–157 –157 –155TBD	100 100 100	40 40 40	≥4955 ≥43 ² ≥49TBD	{≤2.5} {≤2.5} {>2.5 and ≤4.5}
<u>19.7–20.2</u>	<u>–143</u> <u>–143</u> <u>–141</u>	<u>100</u> <u>100</u> <u>100</u>	<u>1 000</u> <u>1 000</u> <u>1 000</u>	<u>≥49</u> <u>≥43²</u> <u>≥49</u>	<u>≤2.5</u> <u>≤2.5</u> <u>>2.5 and ≤4.5</u>
17.8–18.6	<u>–164</u> –162TBD	<u>100</u> 100	<u>40</u> 40	<u>≥49</u> ≥49TBD	<u>≤2.5</u> {>2.5 and ≤4.5}
<u>17.8–18.6</u>	<u>–150</u> <u>–148</u>	<u>100</u> <u>100</u>	<u>1 000</u> <u>1 000</u>	<u>≥49</u> <u>≥49</u>	<u>≤2.5</u> <u>>2.5 and ≤4.5</u>

¹ For certain receive earth stations, see also ADD S9.7A and ADD S9.7B.

² The operational limit applies to non-GSO systems operating at altitudes of 7 000 km or above in order to protect GSO FSS systems employing adaptive coding.

ADD S22.5H

In case of *force majeure*, telecommand and ranging carriers transmitted to non-geostationary satellites in the fixed-satellite service are not subject to the limits given in Table S22-2.

Reasons: Specific provision needed to cover emergency situations.

ANNEX 2 TO CHAPTER 3

EXAMPLE RESOLUTION WWW (WRC-2000)

Protection of GSO FSS and GSO BSS networks from the maximum aggregate equivalent power flux-density produced by multiple non-GSO FSS systems in frequency bands where EPFD limits have been adopted

The World Radiocommunication Conference (Istanbul, 2000),

considering

- a) that WRC-97 has adopted, in Article S22, provisional EPFD limits to be met by non-GSO FSS systems in order to protect GSO FSS and GSO BSS networks in parts of the frequency range 10.7-30 GHz;
- b) that WRC-2000 has revised these limits to ensure that they provide adequate protection to GSO systems without causing undue constraints to any of the systems and services sharing these frequency bands;
- c) that Article S22 includes single entry EPFD limits which apply to non-GSO FSS systems in these bands;
- d) that these single-entry limits have been derived from aggregate equivalent power flux-density (EPFD) masks that are intended to protect GSO networks, assuming a maximum effective number of non-GSO FSS systems of 3.5;
- e) that the aggregate interference caused by all co-frequency non-GSO FSS systems in these bands into GSO FSS systems should not exceed the maximum interference levels that are necessary to protect these GSO systems;
- f) that WRC-97 decided, and WRC-2000 confirmed, that non-GSO FSS systems in these bands are to coordinate the use of these frequencies between themselves under the provisions of No. S9.12 of the Radio Regulations;
- g) that the orbital characteristics of such systems are likely to be inhomogeneous;
- h) that as a result of this likely inhomogeneity, the aggregate EPFD levels from multiple non-GSO FSS systems are not directly related to the number of actual systems sharing a frequency band, and the number of such systems operating co-frequency is likely to be small;
- i) that the possible misapplication of single entry limits should be avoided.

recognizing

- a) that non-GSO FSS systems are likely to need to implement interference mitigation techniques to share frequencies among themselves;
- b) that because the use of such interference mitigation techniques will likely keep the number of non-GSO systems small, the aggregate interference caused by non-GSO FSS systems into GSO systems will also likely be small;
- c) that notwithstanding *considering d)*, there may be instances where the aggregate interference from non-GSO systems could exceed the interference levels given in Annex 1;

d) that administrations operating GSO systems may wish to ensure that the aggregate EPFD produced by all operating co-frequency non-GSO FSS systems in the frequency bands referred to in *considering a)* above into GSO FSS and/or GSO BSS networks does not exceed the aggregate interference levels given in Annex 1,

resolves

1 that administrations operating or planning to operate non-GSO FSS systems in the frequency bands referred to in *considering a)* above, individually or in collaboration, take all possible steps, including by means of appropriate modifications to their systems if necessary, to ensure that the actual aggregate interference into GSO FSS and GSO BSS networks caused by such systems operating co-frequency in these frequency bands does not exceed the aggregate power levels shown in Annex 1;

2 that, in the event that the aggregate interference levels in Annex 1 are exceeded into an operational GSO earth station, administrations operating non-GSO FSS systems in these frequency bands shall expeditiously take all necessary measures to reduce the aggregate EPFD levels to those in Annex 1 or to reduce such interference to higher levels that are acceptable to the affected GSO administration,

requests ITU-R

1 to develop, as a matter of urgency, and complete, in time for consideration by the next WRC, a methodology for calculating the aggregate EPFD produced by all non-GSO FSS systems operating or planning to operate co-frequency in the frequency bands referred to in *considering a)* above into GSO FSS and GSO BSS networks and for comparing the calculated levels with the aggregate power levels shown in Annex 1;

2 to continue its studies on the accurate modelling of interference from non-GSO FSS systems into GSO FSS and GSO BSS networks in the frequency bands referred to in *considering a)* above in order to assist the administrations planning or operating non-GSO FSS systems in their efforts to limit the aggregate EPFD levels produced by their systems into GSO networks,

requests the Director of the Radiocommunication Bureau

to assist in the development of the methodology referred to in *requests ITU-R 1* above.

ANNEX 1 (TO RESOLUTION WWW)

This Annex to Resolution WWW contains tables of interference levels concerning aggregate interference from multiple non-GSO FSS systems, which individually meet the Table S22-1A limits, into GSO FSS and GSO BSS systems.

Studies are continuing in order to avoid unnecessary entries in this Table and in order to provide maximum protection for the GSO FSS and GSO BSS.

TABLE WWW-1A^{1,3}

Limits to the aggregate EPFD_{down} radiated by non-GSO FSS systems in certain frequency bands

Frequency band (GHz)	EPFD _{down} Equivalent pfd-dB(W/m ²)	Percentage of time during which equivalent pfd level EPFD _{down} may not be exceeded	Reference bandwidth (kHz)	Reference antenna diameter, and reference radiation pattern ²
10.7-11.7 in all Regions; 11.7-12.2 in Region 2; 12.2-12.5 in Region 3 and 12.5-12.75 in Regions 1 and 3	-170.0	0	40	60 cm Recommendation S.({4/57})
	-168.6	90		
	-165.3	99		
	-160.4	99.97		
	-160.0	99.99		
	-160.0	100		
	-176.5	0	40	1.2 m Recommendation S.({4/57})
	-173.0	99.5		
	-164.0	99.84		
	-161.6	99.945		
	-161.4	99.97		
	-160.8	99.99		
	-160.5	99.99		
	-160	99.9975		
	-160	100		

	<u>-185</u>	<u>0</u>	40	3 m Recommendation S.{4/57}
	<u>-184</u>	<u>90</u>		
	<u>-182</u>	<u>99.5</u>		
	<u>-168</u>	<u>99.9</u>		
	<u>-164</u>	<u>99.96</u>		
	<u>-162</u>	<u>99.982</u>		
	<u>-160</u>	<u>99.997</u>		
	<u>-160</u>	<u>100.00</u>		
	<u>-190</u>	<u>0</u>	40	10 m Recommendation S.{4/57}
	<u>-190</u>	<u>99</u>		
	<u>-166</u>	<u>99.99</u>		
	<u>-160</u>	<u>99.998</u>		
	<u>-160</u>	<u>100</u>		

- ¹ For certain receive earth stations, see also ADD S9.7A and ADD S9.7B.
- ² Under this Section, reference patterns are to be used only for the calculation of interference from non-GSO FSS systems into GSO FSS ~~and BSS~~ systems.
- ³ In addition to the limits shown in this table, the aggregate EPFD_{down} limits in Table WWW-1A' apply to all antenna sizes greater than 60 cm in the frequency bands listed in this table.

TABLE WWW-1A'

Aggregate EPFD_{down} radiated by non-GSO FSS systems at certain latitudes

<u>100% of the time EPFD_{down}</u> <u>dB(W/(m²·40 kHz))</u>	<u>Latitude (North or South)</u> <u>(°)</u>
<u>-160</u>	<u>0 < Latitude ≤ 57.5</u>
<u>-160 + 3.4(57.5 - Latitude)/4</u>	<u>57.5 < Latitude ≤ 63.75</u>
<u>-165.3</u>	<u>63.75 ≤ Latitude </u>

^{*} ~~No agreement could be reached on EPFD_{down} values for protection of the 3 m and 10 m GSO FSS antennas. See § 3.1.4.1.4.2 a) of the text.~~

MOD

TABLE 1-FSSWW-1B¹

Limits to the aggregate EPFD_{down} radiated by non-GSO FSS systems in certain frequency bands

Frequency band (GHz)	EPFD _{down} dB(W/m ²)	Percentage of time during which equivalent pfdEPFD _{down} may not be exceeded	Reference bandwidth (kHz)	Reference antenna diameter, and reference radiation pattern ²
17.8-18.6	-164	100	40 ³	1 m Recommendation S.({4/57})
	-164	99.9		
	-170	90		
	-170	0		
	-150	100	1 000	
	-150	99.9		
	-156	90		
	-156	0		
17.8-18.6	-164	100	40 ³	2 m Recommendation S.({4/57})
	-164	99.92		
	-166	99.9		
	-173	99.4		
	-173	0		
	-150	100	1 000	
	-150	99.92		
	-152	99.9		
	-159	99.4		
	-159	0		
17.8-18.6	-164	100	40 ³	5 m Recommendation S.({4/57})
	-164	99.992		
	-172	99.8		
	-180	99.8		
	-180	0		
	-150	100	1 000	
	-150	99.992		
	-158	99.8		
	-166	99.8		
	-166	0		

¹ For certain receive earth stations, see also ADD S9.7A and ADD S9.7B.

² Under this Section, reference patterns are to be used only for the calculation of interference from non-GSO FSS systems into GSO FSS ~~and BSS~~ systems.

³ ~~For non-GSO emission bandwidths greater than 40 kHz, the EPFD_{down} limits may be scaled by adding 10 log(non-GSO emission bandwidth/40 kHz) in a reference bandwidth equal to the emission bandwidth.~~

MOD

TABLE WWW-1C¹

Limits to the aggregate EPFD_{down} radiated by non-GSO FSS systems in
certain frequency bands

Frequency band (GHz)	EPFD _{down} dB(W/m ²)	Percentage of time during which equivalent pfdEPFD _{down} may not be exceeded	Reference bandwidth (kHz)	Reference antenna diameter, and reference radiation pattern ²
19.7-20.2	-154 -154 -172 -182	100 99.94 90 0	40 ³	70 cm Recommendation S.(4/57)
	<u>-140</u> <u>-140</u> <u>-158</u> <u>-168</u>	<u>100</u> <u>99.94</u> <u>90</u> <u>0</u>	<u>1 000</u>	
19.7-20.2	-154 -154 -160 -165 -176 -185	100 99.99 99.8 99.8 91 0	40 ³	90 cm Recommendation S.(4/57)
	<u>-140</u> <u>-140</u> <u>-146</u> <u>-151</u> <u>-162</u> <u>-171</u>	<u>100</u> <u>99.99</u> <u>99.8</u> <u>99.8</u> <u>91</u> <u>0</u>	<u>1 000</u>	
19.7-20.2	-154.35 -154.35 <u>-162</u> -191	100 99.998 <u>99.933</u> 0	40 ³	2.5 m Recommendation S.(4/57)-see Note 4
	<u>-140</u> <u>-140</u> <u>-148</u> <u>-177</u>	<u>100</u> <u>99.998</u> <u>99.933</u> <u>0</u>	<u>1 000</u>	

19.7-20.2	-154.35	100	40 ³	5 m Recommendation S.(4/57)-see Note 4
	-154.35	99.99926		
	<u>-161</u>	<u>99.984</u>		
	<u>-175</u>	<u>99.6</u>		
	<u>-184</u>	<u>90</u>		
	<u>-195</u>	<u>0</u>		
	<u>-140</u>	<u>100</u>	<u>1 000</u>	
	<u>-140</u>	<u>99.9992</u>		
	<u>-147</u>	<u>99.984</u>		
	<u>-161</u>	<u>99.6</u>		
	<u>-170</u>	<u>90</u>		
	<u>-181</u>	<u>0</u>		

- ¹ For certain receive earth stations, see also ADD S9.7A and ADD S9.7B.
- ² Under this Section, reference patterns are to be used only for the calculation of interference from non-GSO FSS systems into GSO FSS ~~and BSS~~ systems.
- ³ ~~For non-GSO emission bandwidths greater than 40 kHz, the EPFD_{down} limits may be scaled by adding 10 log (non-GSO emission bandwidth/40 kHz) in a reference bandwidth equal to the emission bandwidth.~~
- ⁴ ~~The masks for the 2.5 m and 5 m antennas have not been agreed. Further adjustments to these masks are required.~~

TABLE WWW-1D²

Limits to the aggregate EPFD_{down} radiated by non-GSO FSS systems in certain frequency bands 30 cm, 45 cm, 60 cm, 90 cm, 120 cm, 180 cm, 240 cm and 300 cm BSS antennas

Frequency band (GHz)	EPFD _{down} dB(W/m ²)	Percentage of time during which EPFD _{down} level may not be exceeded	Reference bandwidth (kHz)	Reference antenna diameter, and reference radiation pattern ¹
11.7- 12.5 GHz In Region 1	-160.400 -160.100 -158.600	0.000 25.000 96.000	40	30 cm DNR ITU-R BO.[Doc. 11/137(Rev.1) Annex 1]
11.7-12.2 GHz and 12.5-12.75 GHz In Region 3	-158.600 -158.330	98.000 98.000		
12.2-12.7 GHz In Region 2	-158.330	100.000		
11.7-12.5 GHz In Region 1	-170.000 -167.000 -164.000	0.000 66.000 97.750		
11.7-12.2 GHz and 12.5-12.75 GHz In Region 3	-160.750	99.330	40	45 cm DNR ITU-R BO.[Doc. 11/137(Rev.1) Annex 1]
12.2-12.7 GHz In Region 2	-160.000 -160.000	99.950 100.000		
11.7-12.5 GHz In Region 1	-171.000 -168.750 -167.750	0.000 90.000 97.800		
11.7-12.2 GHz and 12.5-12.75 GHz In Region 3	-162.000 -161.000	99.600 99.800		
12.2-12.7 GHz In Region 2	-160.200 -160.000 -160.000	99.900 99.990 100.000	40	60 cm DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1]

11.7-12.5 GHz In Region 1 11.7-12.2 GHz and 12.5-12.75 GHz In Region 3 12.2-12.7 GHz In Region 2	-173.75	0.000	40	90 cm DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1]
	-173	33.000		
	-171	98.000		
	-165.5	99.100		
	-163	99.500		
	-161	99.800		
	-160	99.970		
11.7-12.5 GHz In Region 1 11.7-12.2 GHz and 12.5-12.75 GHz In Region 3 12.2-12.7 GHz In Region 2	-160.000	100.000	40	120 cm DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1]
	-177.000	0.000		
	-175.250	90.000		
	-173.750	98.900		
	-173.000	98.900		
	-169.500	99.500		
	-167.800	99.700		
	-164.000	99.820		
	-161.900	99.900		
	-161.000	99.965		
	-160.400	99.993		
	-160.000	100		
11.7-12.5 GHz in Region 1 11.7-12.2 GHz and 12.5-12.75 GHz in Region 3 12.2-12.7 GHz in Region 2	-179.500	0.000	40	180 cm DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1]
	-178.660	33.000		
	-176.250	98.500		
	-163.250	99.810		
	-161.500	99.910		
	-160.350	99.975		
	-160.000	99.995		
	-160.000	100.000		

11.7-12.5 GHz in Region 1 11.7-12.2 GHz and 12.5-12.75 GHz in Region 3 12.2-12.7 GHz in Region 2	-182.000	0.000	40	240 cm DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1]
	-180.900	33.000		
	-178.000	99.250		
	-164.400	99.850		
	-161.900	99.940		
	-160.500	99.980		
	-160.000	99.995		
	-160.000	100.000		
11.7-12.5 GHz In Region 1 11.7-12.2 GHz and 12.5-12.75 GHz In Region 3 12.2-12.7 GHz In Region 2	-186.500	0.000	40	300 cm DNR ITU-R BO. [Doc. 11/137(Rev.1) Annex 1]
	-184.000	33.000		
	-180.500	99.500		
	-173.000	99.700		
	-167.000	99.830		
	-162.000	99.940		
	-160.000	99.970		
	-160.000	100.000		

- Under this Section, reference patterns are to be used only for the calculation of interference from non-GSO FSS systems into GSO BSS systems.
- For BSS antenna diameters 180 cm, 240 cm and 300 cm, in addition to the aggregate limit shown in Table **WWW-1D**, the following aggregate 100% of the time EPFD_{down} limit also applies:

100% of the time EPFD _{down} dB(W/(m ² ·40 kHz))	Latitude (North or South) (°)
-160.0	$0 \leq \text{latitude} \leq 57.5$
$-160.0 + 3.4 * (57.5 - \text{latitude})/4$	$57.5 \leq \text{latitude} \leq 63.75$
-165.3	$63.75 \leq \text{latitude} $

For BSS antenna diameter 240 cm, in addition to the above aggregate 100% of the time EPFD_{down} limit, a -167 dB(W/(m²·40 kHz)) aggregate 100% of the time operational EPFD_{down} limit also applies to receive antennas located in Region 2, west of 140° W, north of 60° N, pointing toward GSO BSS satellites at 91° W, 101° W, 110° W, 119° W and 148° W with elevation angles greater than 5°. [This limit is implemented during a transition period of [15] years.]*

* This transitional regime would be applicable only if the pfd limits in section 5c of Annex 1 to Appendix **S30** are sufficiently relaxed.

ANNEX 3 TO CHAPTER 3

Example of possible modifications for coordination between non-GSO FSS transmitting space stations and GSO receive earth stations with very large antennas

This Annex contains example of regulatory and procedural text for coordination between non-GSO FSS transmitting space stations and GSO receive earth stations with very large antennas, including additions and/or modifications to Articles **S9**, **S11** and **S22** and Appendices **S4** and **S5**.

ARTICLE S9

Sub-Section IIA - Requirement and request for coordination

- | | | |
|------------|--------------------------------------|---|
| ADD | S9.7A | ^{12, 13} <i>a1)</i> for a specific earth station within a geostationary-satellite network in the fixed-satellite service in certain frequency bands in respect of a non-geostationary-satellite system in the fixed-satellite service; |
| ADD | S9.7B | ^{12, 13} <i>a2)</i> for a non-geostationary-satellite system in the fixed-satellite service in certain frequency bands in respect of a specific earth station within a geostationary-satellite network in the fixed-satellite service; |
| ADD | S9.7.A.1
and
S9.7.B.1 | ¹² The coordination of a specific earth station under S9.7A or S9.7B shall remain within the authority of the administration having this station located on its territory. |
| ADD | S9.7.A.2
and
S9.7.B.2 | ¹³ Coordination information relating to a specific earth station received by the Bureau prior to [date TBD <u>to be established by WRC-2000</u>] is considered as complete S9.7A or S9.7B information from the date of receipt of complete information of the associated satellite network under S9.7 provided that the characteristics of the specific earth stations are within the parameters of any typical earth station included in the GSO FSS network coordination request. |
| MOD | S9.8.1
and
S9.9.1 | ⁺²¹⁴ Application of this provision with respect to Articles 6 and 7 of Appendices S30 and S30A is suspended pending a decision of WRC-99 on the revision of these two Appendices. |

Reasons: GSO FSS earth stations with very large antennas may not be adequately protected by the EPFD_{down} limits contained in Table MOD S22-1 and case-by-case coordination of systems operating co-frequency, co-directional links in the space-to-Earth direction would then be required. The proposed ADD S9.7A and ADD S9.7B would require coordination between non-GSO FSS transmit satellites and GSO FSS receive earth stations with very large antennas. By referring to coordination provisions under S9.7A and S9.7B, the request for coordination would be sent by the requesting administration to the Bureau under S9.30. The Bureau would act under S9.34 to identify administrations with which coordination may need to be effected and publish the information in the Weekly Circular. Since coordination between a non-GSO FSS space station and very large GSO FSS earth stations is a new type of coordination that does not currently exist in Article S9, it is necessary to add two new entry points in Article S9:

- One entry point to enable the non-GSO space station administration to request coordination with administrations having specific very large earth station antennas located on their territory.
- Another entry point to enable the reciprocal coordination to take place, i.e. the possibility for an administration planning to implement a specific very large GSO earth station stations located on their territory to request coordination with administrations having non-GSO FSS transmit space.

TABLE S22-1 (MOD)¹

TABLE S22-4 (MOD)¹

ADD

¹ For certain receive earth stations, see also ADD S9.7A and ADD S9.7B.

Reasons: Case-by-case coordination is required by the proposed modifications in ADD S9.7A and ADD S9.7B.

ARTICLE S11

Section II – Examination of notices and recording of frequency assignments in the Master Register

MOD S11.32A c) with respect to the probability of harmful interference that may be caused to or by assignments recorded with a favourable finding under Nos. **S11.36** and **S11.37** or **S11.38**, or recorded in application of No. **S11.41**, or published under Nos. **S9.38** or **S9.58** but not yet notified, as appropriate, for those cases for which the notifying administration states that the procedure for coordination under Nos. **S9.7**, **S9.7A** or **S9.7B** could not be successfully completed (see also No. **S9.65**);¹⁰ or

MOD S11.32A.1 ¹⁰ The examination of such notices with respect to any other frequency assignment for which a request for coordination under Nos. **S9.7**, **S9.7A** or **S9.7B** has been published under No. **S9.38** but not yet notified shall be effected by the Bureau in the order of their publication under the same number using the most recent information available.

Reasons: The insertion of a coordination trigger related to EPFD_{down} level radiated by the non-GSO FSS system into the earth station employing the very large antenna considered when this earth station is pointed to the wanted GSO satellite provides a mechanism to examine the notice with respect to the probability of harmful interference that may be caused to or by above-listed assignments, and therefore S11.38 and S11.41 are applicable.

MOD TO APPENDIX S4

ANNEX 2B (TO APPENDIX S4)

Table of characteristics to be submitted for space and radio astronomy services

The required characteristics for coordinating specific very large GSO earth stations with non-GSO FSS transmit space stations could be items for "Notification or coordination of a GSO network (including Appendix **S30B**)" or "Notification or coordination of an earth station."

(The modifications in either column two or column three need to be incorporated into the full table.)

C – Characteristics to be provided for each group of frequency assignments for a satellite antenna beam or an earth station antenna

MOD

Items in Appendix	Notification or coordination of a GSO network (including Appendix S30B)	Notification or coordination of an earth station
C.1		
C.2.a	X	X
C.2.b		
C.3.a	X	X
C.3.b		
C.4	X	X
C.5.a	X	
C.5.b		
C.5.c		
C.6	X	X
C.7.a	X ²²⁹	X ²²⁹
C.7.b	C ²²⁹	C ²²⁹
C.7.c	C ²²⁹	C ²²⁹
C.7.d	C	C
C.8.a	X ⁷	C ⁸
C.8.b	X ⁷	X ⁷
C.8.c	X ⁶	X ⁶
C.8.d	X ²	
C.8.e	X ⁶	X ⁶
C.8.f		
C.8.g	C ⁴	C ^{4,5}
C.8.h		
C.8.i		
C.8.j		
C.9.a	C	
C.9.b		
C.9.c		
C.10.a	X ²²⁹	C ²²⁹
C.10.b	X ²²⁹	C ²²⁹
C.10.c.1	X ²²⁹	C ²²⁹
C.10.c.2	X ²²⁹	C ²²⁹
C.10.c.3	X	
C.10.c.4	X	
C.10.c.5	X ²²⁹	C ²²⁹
C.10.c.6		

C.11.a	X	
C.11.b		
C.11.c		
C.11.d		
C.12		
C.13		
C.14		

- X Mandatory information.
- O Optional information.
- C This information need only be furnished when it has been used as a basis to effect coordination with another administration.

^{zz9} Information mandatory for coordination under No. ADD S9.7A.

NOTE – Additional characteristics to be provided may include A.4.c, A.1.e.1, A.1.e.2, C.4, B.5 and C.5.b. As a result of decisions that may be made at WRC-2000, these additional characteristics may replace C.10.a, C.10.b, C.10.c.1, C.10.c.2 and C.10.c.5 in the notification or coordination of an earth station column.

Reasons: This is consequential to ADD S9.7A and ADD S9.7B. Administrations will need to submit specific earth station information for earth stations associated with geostationary-satellite networks in the fixed-satellite service meeting the conditions in the proposed addition to Appendix S5.

MOD (to RR App. S4)**D – Overall link characteristics**

(The modifications in either column two or column three need to be incorporated into the full table.)

Items in Appendix	Notification or coordination of a geostationary satellite network (including Appendix S30B)	Notification or coordination of an earth station
D.1	X	
D.2.a	X ⁹	C ⁹
D.2.b	X	

X Mandatory information.

O Optional information.

C This information need only be furnished when it has been used as a basis to effect coordination with another administration.

⁹ Information mandatory for coordination under No. ADD S9.7A.

Reasons: This is consequential to ADD S9.7A and ADD S9.7B and will be required when simple frequency-changing transponders are used on the space station.

ADD

APPENDIX S5
TABLE S5-1 (continued)

Reference of Article S9	Case	Frequency bands (and Region) of the service for which coordination is sought	Threshold/condition	Calculation method	Remarks
No. S9.7A GSO earth station/ non-GSO system	A specific earth station in a geostationary-satellite network in the fixed-satellite service in respect of a non-geostationary-satellite system in the fixed-satellite service.	The following frequency bands: 10.7-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) in Region 2, 12.2-12.75 GHz (space-to-Earth) in Region 3, 12.5-12.75 GHz (space-to-Earth) in Region 1, 17.8-18.6 GHz (space-to-Earth), and 19.7-20.2 GHz (space-to-Earth)	Conditions: i) the frequency bands overlap; and ii) the satellite network using the geostationary-satellite orbit has specific receive earth stations and meets all of the following conditions: a) Earth station antenna maximum isotropic gain greater than or equal to 64 dBi for the frequency bands 10.7-12.75 GHz or 68 dBi for the frequency bands 17.8-18.6 GHz and 19.7-20.2 GHz; b) G/T_1 of 44 dB/K or higher; c) space station emission bandwidth of 250 MHz or higher for the frequency bands 10.7-12.75 GHz or 800 MHz or higher for the frequency bands 17.8-18.6 GHz and 19.7-20.2 GHz; iii) the EPFD _{down} from the satellite system using the non-geostationary orbit exceeds:	i) compare frequency bands; ii) use the maximum antenna gain of the specific receive earth station (Appendix S4 C.10 c) 2)), the lowest equivalent satellite link noise temperature (Appendix S4 C.10 c) 5)), and the space station emission bandwidth (Appendix S4 C.7 a)) in the geostationary-satellite network as given in Appendix S4 data; and iii) use the EPFD _{down} radiated by the non-GSO FSS system into the earth station employing the very large antenna when this antenna is pointed towards the wanted GSO satellite.	The threshold/condition for coordination do not apply to typical receive earth stations operating in satellite networks using the geostationary-satellite orbit.

			<p>a) either $-174.5 \text{ dB}(W/(m^2 \cdot 40 \text{ kHz}))$ for any percentage of time or $[x] \text{ dB}(W/(m^2 \cdot 40 \text{ kHz}))$ for $[y]\%$ of the time in the frequency band 10.7-12.75 GHz;</p> <p>b) either $-151 \text{ dB}(W/(m^2 \cdot \text{MHz}))$ for any percentage of time or $[x'] \text{ dB}(W/(m^2 \cdot \text{MHz}))$ for $[y']\%$ of the time in the frequency bands 17.8-18.6 GHz or 19.7-20.2 GHz.</p>		
No. S9.7B non-GSO system/ GSO earth station/	A non-geostationary-satellite system in the fixed-satellite service in respect of a specific earth station in a geostationary-satellite network in the fixed-satellite service.	The following frequency bands: 10.7-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) in Region 2, 12.2-12.75 GHz (space-to-Earth) in Region 3, 12.5-12.75 GHz (space-to-Earth) in Region 1, 17.8-18.6 GHz (space-to-Earth), and 19.7-20.2 GHz (space-to-Earth)	<p>Conditions:</p> <p>i) the frequency bands overlap; and</p> <p>ii) the satellite network using the geostationary-satellite orbit has specific receive earth stations and meets all of the following conditions:</p> <p>a) Earth station antenna maximum isotropic gain greater than or equal to 64 dBi for the frequency bands 10.7-12.75 GHz or 68 dBi for the frequency bands 17.8-18.6 GHz and 19.7-20.2 GHz;</p> <p>b) G/T_1 of 44 dB/K or higher;</p>	<p>i) compare frequency bands;</p> <p>ii) use the maximum antenna gain of the specific receive earth station (Appendix S4 C.10 c) 2)), the lowest equivalent satellite link noise temperature (Appendix S4 C.10 c) 5)), and the space station emission bandwidth (Appendix S4 C.7 a)) in the geostationary-satellite network as given in Appendix S4 data; and</p>	The threshold/condition for coordination do not apply to typical receive earth stations operating in satellite networks using the geostationary-satellite orbit.

			<p>c) space station emission bandwidth of 250 MHz or higher for the frequency bands 10.7-12.75 GHz or 800 MHz or higher for the frequency bands 17.8-18.6 GHz and 19.7-20.2 GHz;</p> <p>iii) the EPFD_{down} from the satellite system using the non-geostationary orbit exceeds:</p> <p>a) either -174.5 dB(W/(m²•40 kHz)) for any percentage of time or [x] dB(W/(m²•40 kHz)) for [y]% of the time in the frequency band 10.7-12.75 GHz</p> <p>b) either -151 dB(W/(m²•MHz)) for any percentage of time or [x'] dB(W/(m²•MHz)) for [y']% of the time in the frequency bands 17.8-18.6 GHz or 19.7-20.2 GHz.</p>	<p>iii) use the EPFD_{down} radiated by the non-GSO FSS system into the earth station employing the very large antenna when this antenna is pointed towards the wanted GSO satellite.</p>	
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Reasons: This is consequential to ADD S9.7A and S9.7B.